Establishing Backup Fish Stock Kerapu (Blue-lined seabass) Suspended Situbondo

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Abstract. Grouper is an export product, the grouper market is not heard in the country, because most of its products are "sold" abroad alive to some countries such as Singapore, Japan, Hongkong, Taiwan, Malaysia, and the USA . Grouper production still relies on the catch from the sea, although it is now starting the restocking activities the development and growth of the results of these activities have not known the impact on the development of groupers stock. Meanwhile, high demand and economic value have an effect on the frequency of catch effort, so that early information on Grouper stock availability is needed, it is used as an initial step to create sustainable Grouper resource. The objective of this research is to get potential stock of Grouper of Situbondo waters by using Walter and Hilborn model to obtain maximum catch (CMY), catch effort (EMSY) and sustainable potential (Pe). This research uses the descriptive method and sampling technique is done by purposive sampling. The results showed that the value of CSMY 29.894.60,12 kg / year, EMSY 789.166 trip / year, the type of fishing gear is the standard catch tool, the intrinsic population growth rate of Grouper by 47.35% per year, the carrying capacity maximum of water (k) of 252537,451 kg / year, capture ability (q) of 0.0000003 and Grouper (Pe) resource potential of 126268,726 kg / year. While the potential for biomass reserves in 2030, the open access condition is 82,863.95 Kg, when compared to the potential condition of 2030 sustainable, only 49% is left. It is recommended to initiate synergies immediately between exploitation efforts and restocking efforts to create sustainable grouper resources.

Keywords: Grouper, stock, sustainable reserves.

1. Introduction

Based on East Java Capture Fishery Statistics 2016, the production of a group of demersal fish is dominated by grouper (3.74% of total East Java capture fishery), followed by long fish, curry, and fish layur (*Trichiurus savala*). While the potential of groupers spread in several areas throughout East Java (East Java), one of them in Situbondo in the form of land, brackish and marine fisheries, while utilizing the Exclusive Economic Zone (ZEE). Indeed, until now the market of grouper fish does not sound echo in the country, because most of its products "sold" abroad, as an illustration, the price of exports of grouper ducks currently 50 US dollars (about Rp 465,000) per kg, tiger grouper 11 US dollars per kg, and mud grouper 10 US dollars per kg, with the minimum size of exported grouper 500 grams per fish. Grouper fish exports are done alive to some countries such as Singapore, Japan, Hongkong, Taiwan, Malaysia, and the United States, with prices at the fisherman level Rp. 100.000,00, - Rp 200.000,00 per kg of live grouper fish, even for certain species that are more scarce can be appreciated much more expensive [1]. Until now the production of grouper still relies on the catch from the sea, although now started to be pioneered restoking activities the development and growth of the

ACHITS 2019, July 30-31, Surabaya, Indonesia

DOI 10.4108/eai.30-7-2019.2287552

results of these activities have not known the impact on the development of groupers stock. Meanwhile, high demand and economic value have an effect on the frequency of catch effort, so that early information on Grouper stock availability is needed, it is used as an initial step to create sustainable Grouper resource. This is in accordance with the Government's policy (kep.18 / men / 2011), on a balanced management system between resource utilization and conservation efforts, as non-eco-friendly fishing activities are vulnerable to damage, and the implementation of Law No. 27 of 2007 on Coastal Area Management and Small Islands. Although grouper is a renewable biological resource, if no proper management of the catch is possible, it does not rule out the occurrence of overfishing, the problem is how many the existing reserves of available resources can be exploited without disrupting the availability of the stock so that its utilization is sustainable, the problem approach is carried out by the *Walter-Hiborn* method. This study aims to obtain the potential stock of grouper (Blue-lined seabass), maximum catch (EMSY), optimum catch (EMSY) and grouper capture ability.

2. Research Methods

This study uses quantitative descriptive methods and is included in applied research by applying the application of a theory to solve the problem, while the theory used is the Wolter Hilborn method used to predict the stock of sustainable reserves. Data collection methothe d used is purposive sampling to the fisherman of Situbondo, fisherman with special meaning of grouper fisherman (Grouper) owning fishing gear. Since tropical fisheries have multi-species and multi-gear traits, standardization is required, by choosing a standard type of fishing gear based on Grouper's dominant species. This standardization analysis uses the following equation [2].

3. Method of collecting data

Data collection method used is purposive sampling to the fisherman, the fisherman means is fisherman Kerapu (Grouper) which have catching tools. Conversion Tools Fisheries conditions in the tropics have characteristics of various species (multispecies) and a variety of gear multi-gear), therefore for the uniform effort of the catch is required standardization, by choosing the type of standard fishing gear based on the dominant species of the catch. The analysis uses the following equation [2].

$$\text{CpUE} = \frac{Qi_{i=1}^{n} * C_{fish}}{Ei_{t=1}^{n}} \quad \text{.......(1)}$$

Where :

CpUE = the catch per unit effort

$Qi_{i=1}^{n}$ = the catch per unit effort

C_{fish} = average catch by fish catching tool

$Ei_{t=1}^{n}$ = the average effort of the lata catch that is considered standard (trip)

$$\text{RFP} = \frac{Ui_{t=1}^{n}}{U_{standart\ tools}} \quad \text{.......(2)}$$

Where :

RFP = index of fishing gear conversion

$Ui_{t=1}^{n}$ = catch per unit effort each fishing gear

$U_{Alat\ standar}$ = catch per unit effort from the tool standard

$$E_{(Std)t} = \sum_{i=1}^{n} (RFP_1\ x\ E_{i\,(t)}) \quad \text{.......(3)}$$

Where :

$E_{(Std)t}$ = the number of standard fishing tools on year t (trip/catch tool)

RFP_1 = Index of catch gear I I=1–n)
$E_{i\ (t)}$ = Number of catching tools of type I (in year t(trip/fishing gear)
$E_{i\ (t)}$ = Number of Fishing Equipment Type I (Year t (trip /catch tool)

4. The Walter and Hilborn Methods

The Walter and Hilborn models are models of the development of the surplus production model(Schaefer model), which in this analytical model can estimate each of the production function parameters of surplus r, q, and K

$$P_{(t+1)} = P_t + \left[r * P_t - \left(\frac{r}{k}\right) * P_t^2\right] - q * E_t * P_t \quad (4)$$

Where :
$P_{(t+1)}$ = the amount of biomass stock at time t + 1
P_t = the amount of biomass stock at time t
R = intrinsic growth rate of biomass stock
K = maximum carrying capacity of the natural environment
q = capture coefficient
E_t = number of fishing effort to exploit biomass year t (trip/fishing gear)

The number of catches (Catch fishing effort (catch/catch means, E), catch per catch, catch effort (CpUE), and sustainability potential (Pe) under equilibrium conditions are estimated using the following equation:

$$C_{MSY} = \frac{1}{4} * r * \mathrm{k} \quad (5)$$

$$E_{opt} = \frac{r}{2*q} \quad (6)$$

$$P_e = \frac{k}{2} \quad (7)$$

$$U_e = \frac{q*k}{2} \quad (8)$$

5. Result and Discussion

Situbondo is one of the districts in East Java with Geographic position 113º34'21 "-114º27'57" east longitude and 7º36'6 "-7º59'32" LS, with the northern boundary adjacent to Madura district, East borders with Banyuwangi and Bali regency, South is bordered by Bondowoso and Banyuwangi districts, while the west is bordered by Probolinggo regency. While the total area is 1,638.50 km2 (163,850 ha), with 17 sub-districts, 13 of them are coastal villages and have TPI, coastal villages 37, average temperature 23,72- 28,07ºC [3].

5.1 Catch Production.

Based on the results of dominant- fishing gear used to catch grouper fish in Situbondo district is the type of payang and fishing line. While the number of catches landed in Situbondo district during the years 2003-2016, is shown in Figure 1 below:

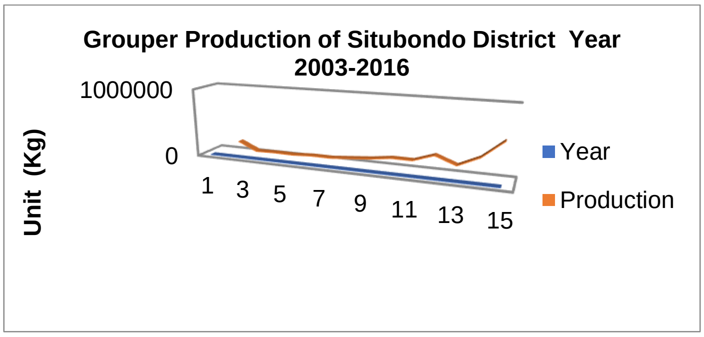

Fig. 1. Catch Production Graph (tons) Grouper(Grouper) Year 2003-2016.

Based on Figure 1, there was an increase in the number of grouper catches in 2016, while the number of trips (*catching effort*) based on the dominant fishing gear used to catch groupers during the period 2003-2016 is shown in the following figure 2:

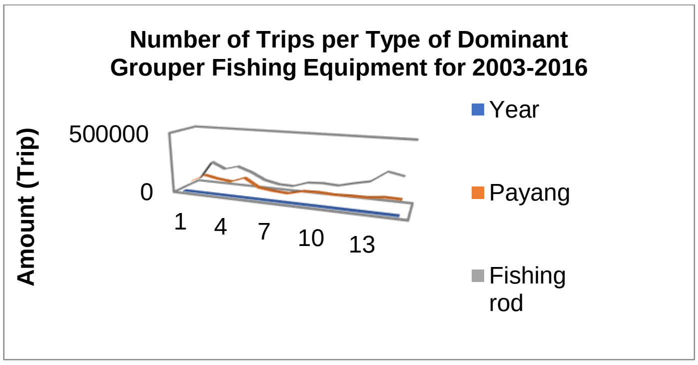

Fig. 2. Graph of Total Trip for each Type of Fishing Gear Grouper (Grouper) The Year 2003-2016.

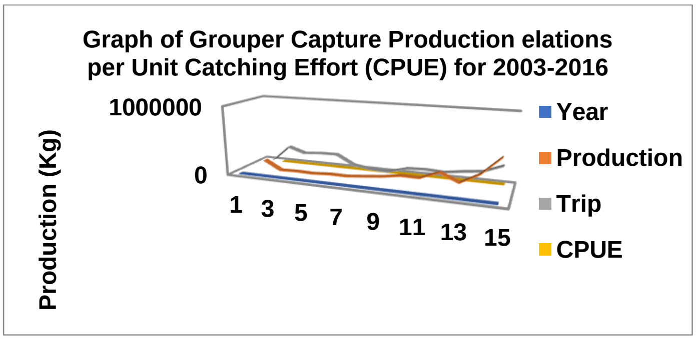

Fig. 3. Graph of Relationships Between Catches Grouper Grouper) per Unit Catching Effort 2003-2016.

Based on the graphs 1, 2 and 3 above, it was found that grouper catch production has increased since 2010 and the highest catch production and trip count occurred in 2016, this indicates that the increase in capture exploitation is also followed by an increase in catch yields, but in this case it must the condition of existing grouper resources has led to the condition of "overfishing" while the previous year (2003-2009) averaged only half of the catch in 2016, the highest number of dominant fishing trips in 2006 in payang fishing gear, and the year 2016 on fishing gear, it turns out that the increase in fishing gear trips was also followed by the addition of catches, however, it needs to be studied more deeply about the use of types of grouper fishing equipment that are environmentally friendly and sustainable. Because fluctuations in grouper resource catches are also influenced by other factors including habitat protection and conservation, for this reason, concrete steps are needed to maintain the sustainability of the existing grouper resources considering that Situbondo is not only a capture fishery area but also has marine and coral reef tourism. the two development programs, such as coral reef management in the Caribbean conducted by AE and Jackson [4] stated that there is a need for equal perception between fishermen and the tourism industry, thereby creating a mature social climate, balanced and strong restrictions on both groups creating coral reef recovery and sustainable resource use. The zoning of both parties can be a step towards long-term conservation of coral reef resources. Whereas according to analysis Glaser. *Et al* [5] which states that socialization and participation of national policies are needed for local fishermen as resource users regarding the management of marine resources to avoid the occurrence of social turmoil about the need for cooperation to create balance in terms of marine conservation management. With regard to capturing exploitation of coral reef resources and grouper species as food stock reserves, a simultaneous restructuring is needed between the benefits of conservation of stock reserves and rezoning, which can reduce the negative impact on fishermen's social vulnerability [6] to protect several endangered grouper species, the protection of mangrove habitats is needed as a place of migration and protection for some grouper species. In the study location it turns out that CPUE values fluctuate during 2003-2016 due to additions and subtractions effort in the effort to capture grouper fish, fluctuations in the CPUE graph decreases further indicating the occurrence of pressure on the existence of grouper resources, but in 2016 catch attempts increased followed by the number of catches. This declining catch condition was as examined by Usseglio. *Et al* [7] against Galapagos sailfin grouper species (*Mycteroperca olfax*) [7] because there are no effective catch management regulations to ensure the sustainability of the Galapagos fisheries for Sailfin grouper species (*Mycteroperca olfax*). In addition to catching factors, this decline is also caused by environmental or conservation such as in the waters of southeastern Brazil against the goliath grouper species, in order to increase the grouper population, it is recommended to conserve goliath grouper populations throughout Brazil including banning fishing and diving tourism [8]. Likewise recommendations made by Bawole, *et al* [9] to create sustainable grouper resources require management arrangements primarily for *Plectropomus maculatus* and *Plectropomus oligocanthus* species separately, the minimum size limit for captured fish can be applied as protection from determining hook size limits and hand line catching activities. The perception of fishermen and divers is different from the decline in grouper species, fishermen generally blame external factors such as climate change, flows, or the offshore fishing industry, while divers blame overfishing and coastal development as a result of research conducted on Caribbean coral reefs by Johnson and Jackson [4] on the degradation of coral reefs as reef fish habitat which resulted in decreased capture production.Conversion of fishing gear As has been described in the research method, the use of tropical fishing gear uses a variety of fishing gear as well as fish species "multispecies and multi-gear" because of that the analysis of catch results requires standardization of fishing gears, due to efficiency (*catchability*) in the catch process fish are influenced by tactics and fishing methods and the construction of fishing gear used. The effort to convert fishing gear aims to unite the trip units as a factor of production, measured in the standardization of tools [10] as the database in analyzing the estimation of stock and status of grouper capture fisheries so that the effort trip unit is obtained. Uniform before the estimation of the condition of the sustainable catch maximum (*MSY*) and the number of catch trips allowed, which is a condition where the stock is in a balance condition.

5.2 Analysis of Grouper Estimation (Grouper)

This grouper stock estimation analysis aims to produce quantitative predictions about permissible catch limits (JTB), the risk of overfishing and providing growth opportunities in order to reach the size according to applicable regulations (Regulation of the Minister of Marine and Fisheries of the Republic of Indonesia Number l / PERMEN-KP / 2015). Preliminary information on the existence of grouper reserves is needed, this is used as a starting point for creating sustainable grouper resources. This is in accordance with Government policy (kep.18 / men / 2011), regarding a balanced management system between resource use and conservation efforts, because fishing activities that are not environmentally friendly are prone to damage, as well as the application of Law No. 27 of 2007 concerning Management of Coastal Areas and Small Islands. Although grouper is a renewable biological resource, if it is not carried out properly management, it does not rule out the possibility of overfishing, the problem is how many existing reserves of resources can be exploited without disturbing the existence of stocks so that the utilization is sustainable, approach this problem is done by the Walter-Hiborn method model. The estimation of Grouper reserves in the waters of Situbondo Regency was analyzed based on the trip aspect per grouper fishing gear dominant in the open source resource conditions in the period 2003-2016 for a period of 14 years. In processing the data, the NonEquilibrium Walter-Hilbron Model analysis is used, with the following results: the value of the intricate growth rate of the population (r) Grouper is 47.35% per year, the maximum carrying capacity of the water (k) is 2525737.451 Kg/ year, capture ability (q) amounting to 0.0000003 and grouper resource potential (Group) (Pe) of 1262868,726 kg/ year.

6. Conclusion

The results of the study concluded that, Fishing gear is a standard capture tool for catching grouper (Blue-lined seabass) with biomass reserve potential stock in open access conditions in 2030 amounting to 82,863.95 Kg, so that when compared with the potential for sustainability in 2030 only 49% remain. Catching effort is 789,166.6 trips / year with the maximum sustainable catch of 29,894.12 kg / year and its capture ability is 0.0000003.

7. Acknowledgements

"This journal article was written by (Samsul Huda Faculty of Agriculture / Fisheries) based on the results of the study (Estimation of Stock of Sustainable Grouper Reserves (Grouper) in Situbondo) which was funded by the University of Dr. Soetomo Surabaya through the 2017/2018 DIPA Program of the University Chancellor "(Contract Number: OU.526A / B.105 / XII / 2017 dated December 27, 2017).

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